

**Listing of All Claims under CFR 1.121**

1 1. (Currently Amended) A high-impedance optical electrode used for measuring bio-  
2 potentials comprising:  
3 a) a light source;  
4 b) an electro-optic modulator:  
5 (1) receiving light from said light source;  
6 (2) modulating said light in response to a bio-potential; and  
7 (3) providing a modulated light output proportional to said bio-potential;  
8 c) a photodetector for receiving and converting said modulated light output from said  
9 electro-optic modulator to an electrical signal;  
10 d) electronic circuitry for providing an electronic output signal; and  
11 e) a pilot tone generated by said electronic circuitry and superimposed on said bio-  
12 potential.

2-4. (Canceled)

1 5. (Currently Amended) ~~The~~ A high-impedance optical electrode used for measuring  
2 bio-potentials ~~according to claim 1 further comprising~~ comprising:  
3 a) a light source;  
4 b) an electro-optic modulator:  
5 (1) receiving light from said light source;  
6 (2) modulating said light in response to a bio-potential; and  
7 (3) providing a modulated light output proportional to said bio-potential;  
8 c) an optical splitter for splitting said light from said light source into at least a second  
9 light portion wherein said second light portion is used as an optical reference signal.

1 6. (Currently Amended) The high-impedance optical electrode used for measuring bio-  
2 potentials according to claim 5 wherein ~~said second~~ a third light portion is received by a  
3 second electro-optical modulator.

7. (Canceled)

1 8. (Currently Amended) The high-impedance optical electrode used for measuring bio-  
2 potentials according to claim 4 5 further comprising an optical phase-shift modulator.

1 9. (Currently Amended) A high impedance optical electrode for measuring bio-  
2 potentials comprising:  
3 a) a light source;  
4 b) a bio-potential;  
5 c) an electro-optic modulator;  
6 (1) receiving light from said light source;  
7 (2) modulating said light in response to a bio-potential; and  
8 (3) providing a modulated light output; ~~and~~  
9 d) a photodetector for receiving and converting said modulated light output from  
10 said electro-optic modulator into an electrical output; and  
11 e) wherein at least one end of said electro-optic modulator connections to at  
12 least one member of a group of members consisting of: an optical fiber, said light  
13 source, and said photodetector, is formed at an angle to vertical.

1 10. (Original) The high impedance optical electrode according to claim 9 wherein said  
2 electrical output is a voltage.

1 11. (Original) The high impedance optical electrode according to claim 9 wherein said  
2 light source is a laser diode.

1 12. (Original) The high impedance optical electrode according to claim 11 wherein  
2 said laser diode is a highly coherent laser diode.

1 13. (Original) The high impedance optical electrode according to claim 11 wherein said  
2 laser diode is a low coherent laser diode.

1 14. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein said light source is a distributed feedback laser.

1 15. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein said light source is a Fabry-Perot laser.

1 16. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein said light source is a vertical cavity surface-emitting laser.

1 17. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein said light source is connected to said electro-optic  
3 modulator with an optical fiber.

1 18. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein said electro-optic modulator is connected to said  
3 photodetector with an optical fiber.

1 19. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 17 wherein said electro-optic modulator is connected to  
3 said photodetector with an optical fiber.

20. (Canceled)

1 21. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 9 wherein at least one end of said electro-optic modulator is  
3 connected to an optical fiber with an optical carrier.

1 22. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 21 wherein an end of said optical carrier connected to said electro-  
3 optic modulator is formed at an angle to vertical.

1 23. (Currently Amended) ~~The~~ A high impedance optical electrode for measuring bio-  
2 potentials ~~according to claim 9~~ comprising:  
3 a) a light source;  
4 b) a bio-potential;  
5 c) an electro-optic modulator;  
6 (1) receiving light from said light source;  
7 (2) modulating said light in response to a bio-potential; and  
8 (3) providing a modulated light output;  
9 d) a photodetector for receiving and converting said modulated light output from said  
10 electro-optic modulator into an electrical output; and  
11 e) wherein at least said electro-optic modulator is enclosed in a housing at least  
12 partially covered with electro-magnetic shielding wherein said electro-magnetic  
13 shielding is a conductive paint.

1 24. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 23 wherein said housing is hermetically sealed.

1 25-26. (Canceled)

1 27. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 23 wherein said housing provides a ground return.

1 28. (Currently Amended) ~~The~~ A high impedance optical electrode for measuring bio-  
2 potentials ~~according to claim 9~~ comprising:

3 a) a light source;

4 b) a bio-potential;

5 c) an electro-optic modulator;

6 (1) receiving light from said light source;

7 (2) modulating said light in response to said bio-potential; and

8 (3) providing a modulated light output;

9 d) wherein said electro-optic modulator is a Mach-Zehnder interferometer comprising a  
10 substrate having formed therein:

11 (1) a light input wave-guide receiving light from said light source;

12 (2) a splitter connected to said light input wave-guide;

13 (3) a first leg light wave-guide connected to said splitter;

14 (4) a second leg light wave-guide connected to said splitter;

15 (5) a combiner connected for receiving light from said first leg light wave-guide  
16 and said second leg light wave-guide; and

17 (6) a light output wave-guide connected to said combiner;

18 (7) a bio-potential plate mounted on said substrate between said first leg light  
19 wave-guide and said second light wave-guide;

20 (8) a first grounding plate mounted on said substrate on a side of said first leg  
21 light wave-guide opposite said bio-potential plate;

22 (9) a second grounding plate mounted on said substrate on a side of said  
23 second leg light wave-guide opposite said bio-potential plate;

24 (10) a pick-up pad electrically connected to said bio-potential plate; and

25 e) a photodetector for receiving and converting said modulated light output from said  
26 electro-optic modulator into an electrical output.

1 29. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 28 wherein said Mach-Zehnder interferometer operates in a linear  
3 region.

30. (Canceled)

1 31. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim ~~30~~ 28 wherein said substrate is crystalline.

32. (Canceled)

1 33. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim ~~30~~ 28 wherein said crystalline substrate comprises  
3  $\text{LiNbO}_3$ .

34. (Canceled)

1 35. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim ~~34~~ 28 wherein said grounding plates are connected to a  
3 ground return provided by a housing.

36 (Canceled)

1 37. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 36 28 further comprising of a shunt resistor connected to  
3 said bio-potential plate and said grounding plate.

1 38. (Currently Amended) ~~The~~ A high impedance optical electrode for measuring bio-  
2 potentials ~~according to claim 30 wherein~~ comprising:

3 a) a light source;

4 b) a bio-potential;

5 c) an electro-optic modulator;

6 (1) receiving light from said light source;

7 (2) modulating said light in response to said bio-potential; and

8 (3) providing a modulated light output;

9 d) wherein said electro-optic modulator is a Mach-Zehnder interferometer comprising a  
10 substrate having formed therein:

11 (1) a light input wave-guide receiving light from said light source;

12 (2) a splitter connected to said light input wave-guide;

13 (3) a first leg light wave-guide connected to said splitter;

14 (4) a second leg light wave-guide connected to said splitter;

15 (5) a combiner connected for receiving light from said first leg light wave-guide

16 and said second leg light wave-guide; and

17 (6) a light output wave-guide connected to said combiner; and

18 e) a photodetector for receiving and converting said modulated light output from said  
19 electro-optic modulator into an electrical output; and

20 f) a spatial filter-is mounted to an end of said substrate.

1 39. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 30 ~~38~~ 38 further comprising a strap for securing said electro-  
3 optic modulator to a patient.

1 40. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 30 38 further comprising a helmet for positioning ~~at least~~  
3 ~~one of~~ said electro-optic modulator on a patient.

1 41. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 40 wherein said helmet provides a ground return for said electro-  
3 optic modulator.

1 42. (Currently Amended) ~~The~~ A high impedance optical electrode for measuring bio-  
2 potentials ~~according to claim 9 further comprising:~~  
3 a) a light source;  
4 b) a bio-potential;  
5 c) an electro-optic modulator;  
6 (1) receiving light from said light source;  
7 (2) modulating said light in response to a bio-potential; and  
8 (3) providing a modulated light output;  
9 d) a photodetector for receiving and converting said modulated light output from said  
10 electro-optic modulator into an electrical output; and  
11 e) a bio-potential plate for receiving said bio-potential and modulating said light in  
12 response thereto.

1 43. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 42 wherein said bio-potential plate is electrically connected to a pick-  
3 up pad for acquiring said bio-potential.

1 44. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 43 wherein said pick-up pad is used without conductive ointments.



1 45. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 43 wherein said pick-up pad has an irregular surface.

1 46. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 43 with said pick-up pad comprising an electrically conducting disk.

1 47. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 43 wherein said pick-up pad is mounted to a housing for said electro-  
3 optic modulator.

1 48. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 42 wherein said bio-potential plate receives said bio-potential  
3 through clothing.

1 49. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 42 wherein said bio-potential plate receives said bio-potential as a  
3 result of capacitive coupling.

1 50. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 9 42 further comprising of an optical power splitter for  
3 receiving light from said light source and providing said light to at least two light  
4 receiving devices.

1 51 (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 50 wherein one of said light-receiving devices is a second  
3 photodetector.

1 52. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 51 wherein said second photodetector is a reference photodetector.

1 53. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 50 wherein one of said light receiving devices is a second electro-  
3 optic modulator.

1 54. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 50 wherein said optical splitter comprises an N-splitter.

1 55. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 50 wherein said optical splitter comprises an X:Y splitter.

1 56. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 9 42 further comprising a phase modulator receiving light  
3 from one of the light source and said electro-optic modulator.

1 57. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 56 with said phase modulator comprising a piezo-electric substrate  
3 having formed therein a light waveguide with a hot electrode and a ground electrode  
4 mounted opposite each other on each side of said waveguide.

1 58. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 57 further comprising a frequency generator for imposing a potential  
3 on said hot electrode with a frequency higher than a frequency range of said bio-  
4 potential.

1 59. (Currently Amended) The high impedance optical electrode for measuring bio-  
2 potentials according to claim 9 42 further comprising electronic circuitry for processing  
3 said electrical output from said photodetector.

1 60. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 with said electronic circuitry comprising post photodetector  
3 processing.

1 61. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 with said electronic circuitry comprising DC transient suppression  
3 circuitry.

1 62. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 with said electronic circuitry comprising amplification circuitry.

1 63. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 with said electronic circuitry comprising filtering circuitry.

1 64. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 with said electronic circuitry comprising pilot tone generation  
3 circuitry.

1 65. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 59 wherein a pilot tone from said pilot tone generation circuitry is  
3 superimposed on said bio-potential at a frequency outside of the frequency range of  
4 said bio-potential.

1 66. (Original) The high impedance optical electrode for measuring bio-potentials  
2 according to claim 65 wherein said pilot tone is applied directly to a patient.

1 67. (New) An optical electrode for measuring bio-potentials comprising:  
2 a) a low coherent laser diode light source;  
3 b) a bio-potential;  
4 c) an electro-optic modulator;  
5 (1) receiving light from said light source;  
6 (2) modulating said light in response to a bio-potential; and  
7 (3) providing a modulated light output;  
8 d) a photodetector for receiving and converting said modulated light output from said  
9 electro-optic modulator into an electrical output.